

Technology Needs

John C. Stennis Space Center

Rocket Engine Altitude Simulation Technologies

John C. Stennis Space Center is embarking on a very ambitious era in its rocket engine propulsion test history. The first new large rocket engine test stand to be built at Stennis Space Center in over 40 years is under construction. The new A3 Test Stand is designed to test very large (294,000 lbf thrust) cryogenic propellant rocket engines at a simulated altitude of 100,000 feet. A3 Test Stand will have an engine testing chamber where the engine will be fired after the air in the chamber has been evacuated to a pressure at the simulated altitude of less than 0.16 PSIA. This will result in a very unique environment with extremely low pressures inside a very large chamber and ambient pressures outside this chamber. The test chamber is evacuated of air using a 2-stage diffuser / ejector system powered by 5000 lb/sec of steam produced by 27 chemical steam generators. This large amount of power and flow during an engine test will result in a significant acoustic and vibrational environment in and around A3 Test Stand.



Projected A3 Test Stand

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A3 Test Stand will be a unique test stand configuration and operating system. Due to the unique nature of this test facility, new technologies and measurement techniques will need to be developed for this environment. These include but are not limited to:

- a. Vacuum leak detection
- b. New sealing technologies for large cryogenic piping and other mechanical and electrical penetrations entering this very large test cell wall to seal against this unique environment
- c. Methods of generating vacuum for test, measurement and calibration of test stand systems and instrumentation
- d. Fatigue life prediction techniques for the thousands of square feet of sheet metal used in the construction of the test chamber and diffuser ducting which will be cycling between ambient and vacuum pressures and be subject to dynamic loading during engine hot fire
- e. Inspection techniques for the vacuum chamber structures and diffuser ducting
- f. Vibration monitoring and analysis
- g. Vibration isolation

Technology Challenges

Most of the technology challenges are the result of the unique configuration and operating methodology for the A3 Test Stand. A number of subscale tests have been, and will be conducted, to understand and mitigate as many problems and issues as possible. Every effort is underway to anticipate and minimize areas where problems could occur.

More Information

For additional information, or to discuss ideas about this call 228-688-1929 or write ssc-technology@nasa.gov.